TECHNICAL NOTES

LAKE STATES FOREST EXPERIMENT STATION
U.S. DEPARTMENT OF AGRICULTURE · · FOREST SERVICE

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Stack Drafts Provide Optimum Ignition and Coaling Conditions For Charcoal Production

Using a small blower fan to create a draft in kiln stacks seems to offer the best overall chance for creating accelerated ignition and coaling conditions in charcoal kilns without sacrificing final yields.1/

This stack-draft method (fig. 1) is a development of the Lake States Station's charcoal research program carried on at the Argonne Experimental Forest near Three Lakes, Wis.

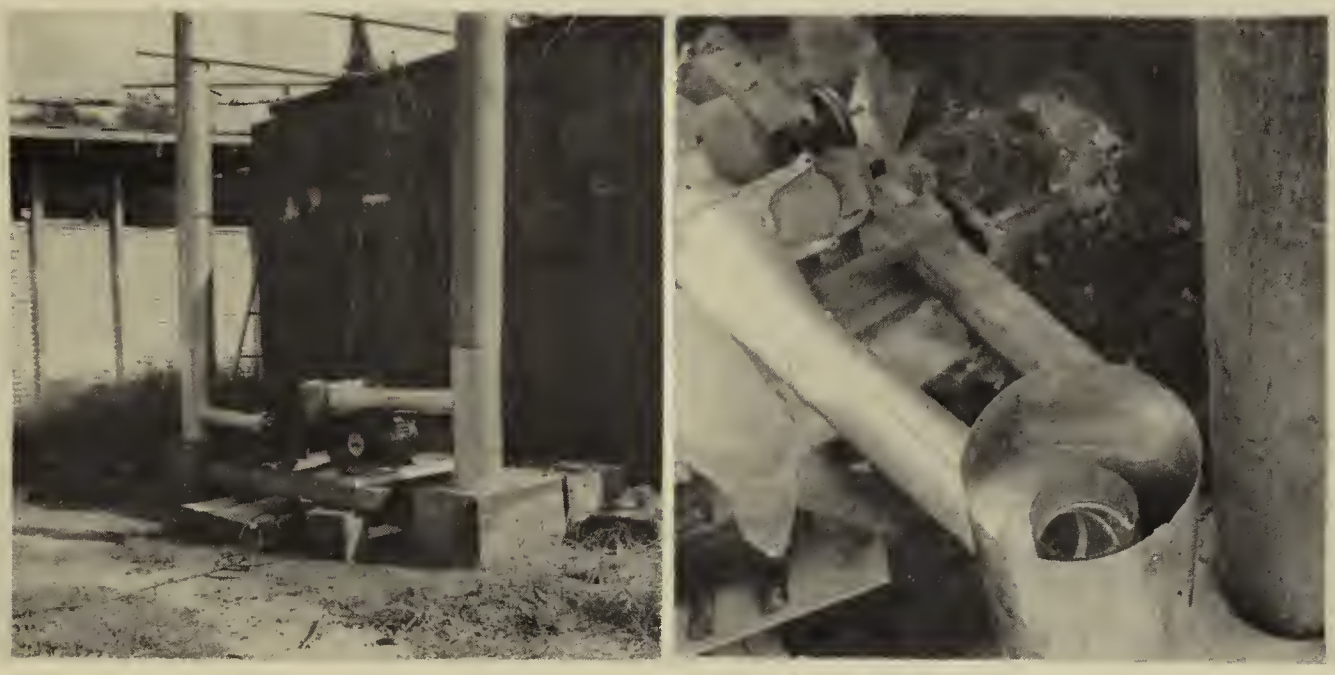

Figure 1.--Stack-draft method. Left, a double-blower fan supplies air to stacks. Right, inside of 8-inch stack at junction of 4-inch pipe from blower fan.

Early acceleration experiments on the Argonne Forest showed that coaling time for air-seasoned sugar maple roundwood could be reduced 40 percent by using four stacks, one placed at each corner of the kiln, and firing the center of the charge.2/ This method, however, is not satisfactory for carbonizing green wood nor is it acceptable by commercial operators using rectangular-shaped kilns.

With four stacks, it is necessary to use a blower fan at the central combustion chamber since all of the stacks will not draw properly under most atmospheric conditions. This concentration of all of the heat generation at the center tends to burn up more of the charge than does spreading the fuel combustion along one end of the charge. Overburning losses from center firing were greater in green wood than in air-seasoned wood, and the greatest volume losses occurred in green slabs and stovewood.

In our experiments, green sugar maple slabs and stovewood were the most difficult raw materials to carbonize under accelerated coaling conditions. Therefore, nine burns were made with this material in order to compare the end-fired stack-draft method with the center-fired four-stack method and the conventional or end-fired natural-draft method.

All burns were made in experimental composite-wall kilns, and the wood charges averaged 3.5 cords. From these nine burns, the average ignition and coaling times are shown in table 1 and the yields in table 2.

The stack-draft method did not appear to accelerate coaling as much as the center-firing method, but, compared with conventional end firing, it did reduce the coaling cycle 25 percent. During ignition, the stack-draft method is probably superior to all others. Figure 2 compares ignition by the stack-draft and conventional methods.

Charcoal yields from the stack-draft method compared well with those from conventional methods and were considerably better than yields by the center-firing method.

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1/ Method suggested and designed by Harold C. Bell of the Lake States Forest Experiment Station, Argonne Experimental Forest.

2/ Lane, Paul H. Wood carbonization in kilns. Forest Prod. Jour., X:344-348 illus. 1960.

Figure 2.--Left, stack-draft method. Three minutes after ignition all stacks are drawing and there is even combustion across air intake ports. Right, conventional or natural-draft method. Fifteen minutes after ignition only one stack is drawing and smoke is backing up through several air intake ports.

Table 1.--Average ignition and coaling times for green sugar maple slabs and stovewood by method of operation

Operating method	No. of burns	Ignition		Coaling time
		Average torch time	Average time for all stacks to draw	
		Minutes	Minutes	Hours
A-Stack draft, end-fired; fan through 2 stacks	2	3.5	1	21
B-Center-fired; fan through central combustion chamber; 4 stacks	3	12	12	18
C-Conventional end-fired, natural draft; 2 stacks	4	22	90	28

Table 2.--Average yields for green sugar maple slabs and stovewood by method of operation

Operating method	Wood moisture, percent	Charcoal yield		Brand volume, 1/ percent of green wood volume
		Percent of oven-dry wood weight	Percent of green wood volume	
A-Stack draft	55	31.4	42.2	1.4
B-Center-fired	55	22.2	25.0	8.7
C-Conventional	50	30.7	40.5	13.0

1/ Amount of charge that was not completely carbonized.